

CHEETAL



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SAMBUR AT HOME (in the Siwaliks)





Photo No. 1

Acer oblongum—Stump at Motheronwala swamp. Original forest has been completely destroyed and many of the trees earlier described by Kanjilal (1901) are now absent or represented by stumps.



Photo No. 2

A view of swamp forest situated near Khiri in Eastern Doon still left from destruction. Kanjilal (1901) said about it "in respect of grandeur of forest this exceeds by far the other swampy areas."

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World Conservation Strategy Launch

Prime Minister Srimati Indira Gandhi addressed the World conservation strategy launch on World Conservation Day on March 6, 1980 at Vigyan Bhawan, New Delhi. She suggested that conservation of natural resources should be made a way of life with every man, woman and child and this would pave the way for rapid economic development without causing ecological damage. Mrs. Gandhi warned that human civilization itself could not endure long if reckless exploitation of natural resources and ecobalances continued unchecked. Interest in conservation was not a sentimental one but the discovery of a truth well known to ancient sages.

Mrs. Gandhi added that in their anxiety to conserve other forms of life "let us not contribute to the denegation of human beings. People can be taught to live in peace with nature and themselves only if they are assured of food, water, shelter and work"

Mrs. Gandhi hoped that the launching of a national conservation strategy would be followed by vigorous efforts all over the country to design and promote simple programmes of eco-development of educational and economic values to the local population. programmes such as "a tree for every child," nutrition gardens, forest farming, raising of energy plantations, organic recycling through conservation and use of waste products and harnessing of renewable forms of energy based on sunlight, wind and bio-gas were all potentially valuable mass movements if they were formulated thoughtfully and implemented with the involvement of the local population.

Underlying the need for saving natural living resources, Rao Birendra Singh, Minister of Agriculture, said that areas that were of critical environmental and ecological importance were being identified. Already 200 wildlife reserves had been constituted. Marine areas off the coasts were being demarcated to secure marine wealth. It was also proposed to set up marine parks.

Dr. David A. Munro, Director-General of IUCN, remarked that the World Conservation Strategy was a response to the need to make development sustainable. The earth's capacity to meet human needs was being severely reduced and the strategy enunciated three main objectives to arrest this deadly decline: to maintain essential ecological processes and life support systems, preserve the variety of life, and use species and ecosystems sustainably.

Dr. Munro said the strategy suggested action at different levels. At the technical level, "we must control the utilisation of species, check soil erosion, manage watersheds, establish parks and look after them carefully". At the policy level "we need to propose and adopt national conservation strategies to ensure that conservation principles pervade deployment planning." There was need for improved environmental planning and more thoughtful allocation of land and water uses.

White Tiger Breeding—Its Economic Potentialities

By

M.M. PANT* AND I.D. DHARIYAL**

Summary

The breeding of white tiger in India is a unique achievement in the animal history and constitutes a biological evolution of intrinsic scientific value. In this paper an attempt has been made to analyse the breeding of white tigers in captivity. The results of breeding 26 mating pairs, were analysed in the light of Mendel's genetic theory to determine the resultant colour of the off spring as a direct sequel to the various colour combinations of the copulating pairs. The observations are based upon a close study of the progenies entailed in as many as 71 ensuing litters. The analysis has yielded positive results. The technique of breeding white tiger has been established in no uncertain manner. The white tiger in India as a distinct breed has thus come to stay. It holds great future possibilities not only for its aesthetic rarity but also for its prospective demand in the world market as a sterling commodity of trade value. India should take initiative to launch breeding cells in its leading Zoological parks. The project deserves urgent implementation on a commercial scale to give India the coveted lead in this pioneer venture.

There is nothing like 'incest' in the wild. All procreative processes are naive and natural unhindered by stigmatic compunctions and prompted merely by season and purpose. The incidence of white tiger¹ owes purely to inbreeding, which phenomenon holds a unique parallel historically in sophisticated human tradition. King Ikhnaton (Akhenaten, 1370-1353 B.C.) married one of his own daughters and king Rameses II (1329-1273 B.C.) spoused two of his own². The Pharaohs of ancient Egypt looked upon what we may allude as 'incestuous marriage' with much favour and penchant. Queen Cleopatra (69-30 B.C.) took her own minor younger brother, Ptolemy XIII, for husband and consort³.

*Forest Economist, F.R.I. & Colleges, Dehra Dún.

**Lecturer, Department of Mathematics, Indian Institute of Technology, Kanpur.

¹White tigers are 'light ivory—coloured to white or creamy white with typical black—brown stripes, pink nose and pads and pale blue eyes, which often turn yellowish when the animal is excited and the pupils are opened very wide'. The white tigers are not pure albinos.

Normal coloured tiger's body colouration is reddish—yellow to rust—brown on the upper side with a whitish underside. The body is covered by black stripes. Young tigers have similar colouration to adults, but their stripes are more grey-brown than those of the mature animals.

²Egyptian Civilization, The Encyclopedia Americana, Vol. 10, Page 14.

³The Encyclopedia Americana, Vol. 7, Page 89.

In the Egypt of the Pharaohs the concept of the so-called "incestuous" marriage obviously arose through an over zeal to preserve royalty at its best. The propagation and ultimate proliferation of white tiger as a distinct species discussed herein is founded on an identical basis of thought and design. MOHAN, the first white tiger when mated with his own offspring RADHA, produced 11 white and 3 normal tawny coloured tigers; and when mated with his own second generation offspring SUKESHI, produced 10 cubs—all white.

However, there is a marked difference between human and animal amours. Whereas the animal sexual urge is an expression of natural procreative instinct, that of man's is a diabolical craving—endless and boundless. Beaunarchais has rightly observed "man differs from the animal in eating without being hungry, drinking without being thirsty and making love at all seasons".

Unlike humans, sex among animals is not unrestrained; the rejection of the male by the female except in periods of rut reduces sex to a much more modest role. On the contrary, human sex indulgence, its tempo and intensity, are biologically untenable. However, the observations are merely incidental and quite beside the theme.

The recent induction of white tiger in India is a unique development in the animal world and constitutes a biological epoch of uncommon scientific significance. The entire portion of the strain of white tiger (white mutant of *Panthera tigers*) in the world today is the outcome of a brilliant plan and its successful implementation by the former Maharaja of Rewa state—Mr. Marthand Singh.

In this paper an attempt has been made to analyse the breeding of white tigers in captivity in world. The object is to find out what colour combination of males and females always leads to the production of white tigers as also to analyse the results in the light of Mendel's genetic theory*. The paper also analyses certain economic aspects of the subject and examines the possibilities of developing white tigers as a potential commodity for export.

The Data Base

The data for this study has been obtained through the kind courtesy of Shri M.B. Peter, Director and Dr. J.H. Desai, Joint Director, Delhi Zoological Park.

The white tigers were the sole property of the Maharaja of Rewa since May, 1951 to May 1963 and were in great demand all over the world. The Maharaja sold one of the cubs, MOHINI of 1958 litter to Washington Zoo in 1960. The Government of India, on learning of this transaction, immediately imposed a ban on the export of white tiger cubs and started negotiations with the Maharaja. The white tigers constituted a unique national asset and

*Austrian Monk, Gregor Mendel, (1822-84) discovered two basic rules of inheritance which laid the foundation for all later advances in understanding all processes of heredity.

Government's anxiety about their future possibilities was but natural. After protracted negotiations an agreement was reached in May 1963 between the Maharaja of Rewa and the Government of India regarding the disposal of 10 tigers (8 white and 2 normal coloured hybrids bearing white colour producing genes). The Maharaja agreed to make a 'gift' of 2 normal coloured tigers and a pair of white tigers to the Delhi Zoological Park; 4 white tigers were to remain Maharaja's private property and the remaining pair of white tigers (MOHAN and SUKESHI) was to be maintained at Rewa at the expense of the Government of India. In addition, an important condition of the 'gift' was that "the litters of the two pairs of white tigers gifted by the Maharaja to the Government of India were to be shared equally between the Maharaja and the Government of India". The first female cub was to be included in the Maharaja's share. The Maharaja was at liberty to dispose off his share of the white tigers in any manner he liked. The Government also agreed to permit the Maharaja the export/sale of the 4 white tigers. The Maharaja sold two of these, CHAMPAK and CHAMELI, to Bristol Zoo in June 1963 and later two more were sold to Alipore Zoo.

MOHAN and SUKESHI stopped breeding in 1968. Soon MOHAN, the progenitor of the white tiger fell ill and eventually died in December 1970. SUKESHI was then presented to the Maharaja who, however, considered it more appropriate to send her to the Delhi Zoo, as an exhibit.

Under the agreement between the Government of India and the Maharaja, the latter was entitled to 50 percent of the white progeny. However, the entire cost of maintenance upto the time of the division (5-6 month old cubs) was to be borne by the Government of India. According to the terms : (i) at Rewa, the white tigers were to be fed on mutton (at 12 kg per head per day. Incidentally, mutton was more expensive than beef fed in equal quantity to the white tigers at Delhi), (ii) two tigers were to be maintained at Rewa by the Government of India (The cost of supervision at Delhi was very nominal because the same zoo keeper looked after other animals, whereas at Rewa supervisory staff was needed for only 2 tigers). As a result of this agreement, the Maharaja of Rewa got 6 white cubs as his share.

Breeding of white tigers

In Mendel's time it was generally supposed that if alternative forms of a trait are cross bred, a blending of the traits would result. Thus if grey and black parents mated, like paints, a dark grey coloured offspring should be produced. Mendel was the first to reach the conclusion that blending of inheritance did not occur and that traits remained distinctly intact. His law of segregation states that: "genes do not blend, but behave as independent units,

they pass intact from one generation to the next, where they may or may not produce visible traits depending on their dominant characteristics”.

If we hold that white coat with black stripes instead of the normal brown pigment with black stripes as a trait then the actual breeding of white tigers of 26 mating pairs (producing 193 cubs in 71 litters) shows that there is no blending of the white and brown colours—A results strictly in accordance with Mendel’s law of genetics. The offsprings are either white or normal coloured but never a mixture of the two blends.

Mendel also stated that genes segregate at random thereby producing predictable ratios of traits in the offspring. The white tiger breeding data was analysed by the authors to find out if the colour of the progeny can be predicted from the colour of the parents : Let AA denote the genotype of a pure white tiger and aa that of a purely normal coloured tiger. A mixed genotype will be denoted by Aa if white is dominant and Aa otherwise. ‘X’ denote a mating. We have the following possibilities:

$$\begin{array}{lll}
 AA \times aa & \longrightarrow & \underline{Aa} \text{ or } \underline{Aa} \\
 AA \times \underline{Aa} \text{ (or } \underline{Aa}) & \longrightarrow & AA, \underline{Aa} \text{ or } \underline{Aa} \\
 \underline{Aa} \text{ (or } \underline{Aa}) \times \underline{Aa} \text{ (or } \underline{Aa}) & \longrightarrow & AA, \underline{Aa} \text{ or } \underline{Aa}, aa
 \end{array}$$

The following tables give the frequency distribution of the offsprings litterwise and cubwise respectively of the white tiger progeny. In each cell there are two numbers. The one in boldprint corresponds to white and the other to normal coloured offspring.

Litter – Distribution
Genotype of Male Tiger

Genotype of Female Tiger		AA	<u>Aa</u>	<u>Aa</u>	aa	
	<u>Aa</u>	5 0	26 0	2 5	1 6	34 8
	<u>Aa</u>	3 1	5 4	$\frac{3}{4}$ $\frac{1}{4}$	1 7	$9\frac{3}{4}$ $12\frac{1}{4}$
	aa	0 3	—	0 4	—	0 7
		8 4	31 4	$2\frac{3}{4}$ $6\frac{1}{4}$	2 13	

Cub—Distribution
Male's Genotype

Genotype of Female Tiger		AA	Aa	Aa	aa	
	Aa	10 0	62 0	7 5	2 17	81 22
	Aa	11 3	16 10	3 1	2 22	32 36
	aa	0 10	—	0 12	—	0 22
		21 13	78 10	10 18	4 39	

The results show that:

- White male mating with normal coloured hybrid female having white colour producing genes, produces 67.5 per cent white cubs in 61.5 per cent litters.
- White male mating with normal coloured female (not having white colour producing genes, does not produce a visibly white tiger. The offspring is normal coloured.
- White female mating with normal coloured male not having white colour producing genes produces 10.5 per cent white cubs in 14.4 per cent of the litters.
- White female mating with normal coloured male having white colour producing genes produces 58.3 per cent white cubs in 50 per cent of the litters.
- White male mating with white coloured female does not produce a visibly normal coloured tiger. It produces a white offspring.

The mortality among the cubs was mainly because either they were still born or they were neglected by the mother after birth. These were very pronounced during the first year—61 cubs out of a total of 193, roughly 32%, died. Research is therefore needed to develop suitable techniques to minimise post-birth casualties.

The fecundity of white tigers is variable: MOHAN, the first white tiger fathered 34 cubs (21 white and 13 normal coloured) in 15 years; RAJA, male offspring of MOHAN and RADHA, fathered 28 cubs (23 white and 5 normal coloured) in about 9 years; BEGUM, the progenator of white breed, gave birth to 22 normal coloured cubs in 7 litters and had a

productive life of 7 years; RADHA (normal coloured female offspring of MOHAN and BEGUM) gave birth to 23 cubs (15 white and 8 normal coloured) in 6 litters and had 10½ years of cub bearing life; RANI, female offspring of MOHAN and RADHA produced 18 white cubs in 7 litters during 7 years.

In the Zoos, the cubs are weaned at the age of 3 months. The tigress is mated again in her following oestrus and within 105 to 112 days, another litter is born. In some foreign Zoos the cubs are removed for hand-rearing as soon as they are born and the tigress is mated again when she comes to heat. However, even in such cases more than two litters per year may not be possible, oestrus can be induced by hormonal injections. A healthy animal responds more readily to this treatment.

For optimum production of white tigers, it is expedient to breed 4 years old pair of white tigers in the Zoo. Each female with a cub bearing span 7 years is capable of producing 15 to 25 cubs. A white tiger may father 15-30 cubs and have a longer breeding life than that of a female. Breeding on a regular basis in Zoological gardens should, therefore, constitute an objective of management of white tigers. The objectives are ostensibly two fold: (i) prized exhibits, and (ii) prized commodity of export potential.

Pricing of white tiger

In view of the extreme rarity of the white tiger as also its uniqueness, the normal methods of price determination cannot be applied in its case. Records maintained at Delhi Zoo indicate that the white tiger (including normal coloured hybrids having white colour producing genes, are larger in size such as shoulder height, circumference and body length, skull size. etc., compared with their normal coloured counterparts. (Sankhala, 1969).

The principal determinant of price in the case of white tigers is, however, not so much their superior breed as their extreme rarity in the cosmos.

The Maharaja of Rewa sold 7 white tigers (including tigress) at prices ranging from Rs. 50,000/- to Rs. 78,500/- per head during the period 1960 to 1967. The price fixation was evidently arbitrary. During the same period, the price of a normal coloured tiger varied from Rs. 8,000/- to 15,000/-. The cost of breeding and upkeep of white tigers is only slightly more than that of the normal coloured tigers. On an average, the annual upkeep and maintenance cost of a tiger in an Indian Zoo is Rs. 4,000-Rs. 5,000, in Bristol around £ 500 (Greed, G.R., 1977) and in Washington Zoo \$ 5,000-\$ 6,000 (estimated). Considering this, the much higher prices fetched by white tiger, are indeed, significant.

The first female white tigress was sold to the National Zoological Park, Washington, D.C., U.S.A. for \$ 10,000. RADHA'S 1960 litter from MOHAN (consisting of a normal

coloured female and two male white cubs) was sold to Alipore Zoological Garden, Calcutta, for Rs. 94,000. In 1963, Bristol Zoo purchased CHAMPA and CHAMELI a pair of white tiger cubs (born in March, 1962) for Rs. 1,00,000. These tigers have since multiplied and presently there are eight white tigers at the Bristol Zoo. Unlike other resources, white tiger population can be multiplied by the purchaser, and in turn the owner can bargain arbitrary price.

Presently the price of a normal coloured tiger for sale within the country, as approved by the Agriculture Ministry, is Rs. 15,000/-. Its export is banned.

It is difficult to assess objectively the price for a white tiger also because of the typical nature of the producers' market. The future pricing policy of white tiger may largely depend upon its eventual evaluation at the Bristol and Washington Zoos (Vis-a-vis that in India). In the meantime nothing, however, can prevent India from formulating its own pricing policy. The following prices for export barter trade proposed herein are by no means irrationally based:

White tiger cub, 6 months to 1 year old	...	Rs. 1,00,000
White tiger/tigress over 1 year below, 2 years old	...	Rs. 2,00,000
White tiger pair (over 1 year and below 3 years)	...	Rs. 5,00,000
Normal coloured hybrid tiger having white colour producing genes, 6 months to one year old	...	Rs. 50,000

Further, it may be feasibly advantageous, if the outright sales are royalty oriented. The basis for imposing recurring royalties may be determined through mutual negotiations between the seller (government) and the buyer. The white tiger may also be bargained suitably for acquiring some rare exotic zoo animals. It may also be used as a rare gift from India to her friendly countries.

White tiger breeding project

For quite sometime to come, white tigers will command a high price in the world market because of their extreme rarity⁴. A separate project to multiply white tigers, therefore, needs to be drawn using the results of this study. Perhaps, this project could also be a part of the Project Tiger.

Until now the white tiger breeding activity has been left almost entirely to the initiative and drive of the individual Zoo Directors and staff of the Zoological Parks mainly at

⁴In November, 1978 their total population (in captivity) in the world was 37—11 at Delhi, 7 at Calcutta, 1 at Gauhati, 8 at Bristol (UK), 10 at Washington (USA). Besides these, one Howthorn Circus Corporation, Illinois, U.S.A. has a white tigress. The Corporation, reported on 17.4.1973 that they had an 11 months old white tigress. This tigress—born to one of their female Bengal Tigress—had brown stripes (the Indian white tigers have black stripes) and could possibly be 'Albino'. The circus authorities were interested in propagating the unusual strain.

Delhi and Calcutta; very little attention, if any, has been paid to its economic potential to the country. If concerted programmes for breeding white tigers are taken up, we may, in the near future, have surpluses for export. In this context, we cannot overlook the fact that the white tiger population at Bristol and Washington Zoos are multiplying at a faster rate. Given better care, facilities and resources, the white tiger population in India can grow faster than those in U.K. and Washington. Immediate attention is, therefore, needed to develop the white tiger industry by adding breeding centres to the Zoological parks in the country. The concentration of closely bred tigers in Calcutta and Delhi Zoological gardens should be reduced so as to minimize the chances of mating amongst close relations.

Planning is also needed to introduce fresh blood with a view to evolve new lineages of white tigers. Suitable breeding centres can also be located in Surguja district of Chhatisgarh division, Sidhi district of Rewa division and National Park in Bandhava Garh. In addition to the above, there is an urgent need of scientifically investigating the unusual casualties among white tigers (still born cubs and those dying within a few days after birth). Congenital defects due to inbreeding might be one of the reasons. There is also an urgent need to develop a suitable vaccine against feline interitis. Some mortalities can be avoided if hand rearing is undertaken as in Bristol and Washington Zoos.

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Two New Distributional Records of Snakes from the Dun Valley and the Corbett National Park, Uttar Pradesh

By

D.P. SANYAL, S.K. TALUKDAR AND GOURI DASGUPTA

Zoological Survey of India, 27 Chowringhee Road, Calcutia-16.

While studying a small collection of snakes from the Dun Valley and the Corbett National Park, Uttar Pradesh, India, the authors came across two well-preserved specimens of *Enhydryis sieboldi* (Schlegel) and *Ahaetulla nasutus* (Lacepede) in the collection of the Zoological Survey of India, Calcutta, which has not hitherto been recorded from these areas. The aforesaid species of snakes, therefore, constitute the first positive records of their occurrence from the Dun Valley and the Corbett National Park, thereby extending the known range of their zoogeographical distribution in northern India.

1. *Enhydryis sieboldi* (Schlegel)

Material studied: 1 example, Corbett National Park, Nainital District, U.P., India, coll. R.N. Chopra, 23.VI. 1976.

Pholidosis: 1 preocular and 2 postoculars, extending to below the eye; 2 supralabials, 3rd, 4th and 5th touching the eye, last 2 horizontally divided; 1 loreal; round. Body stout; Scale in 29:19:25 rows. Ventrals 148; Sub-caudal 47.

Remarks: According to Smith (1943) the species is known to occur in Travancore, Bombay, Delhi, Agra, Saugar, Fyzabad, Pusa, Patna and Champaran within the Indian limits. Elsewhere it is recorded from Mymensingh (Bangala desh) and Samaguting (Nagaland) and Pegu (Burma). Fleming, Jr. and Fleming Sr. (1973) reported the species for the first time from Nepal. The present finding constitutes the first positive record of the species from the Corbett National Park, U.P. and thereby it extends the known range of its distribution further to northeast.

2. *Ahaetulla nasutus* (Lacepede)

Measurements: Standard length (snout to vent) 300 mm., tail 135 mm., total length 435 mm.

Remarks: According to Smith (*op. cit.*) the present species is distributed in Peninsular India and Sri Lanka excluding the Ganga Valley west of Patna (Bihar) and Bengal within the Indian limits. It is also known to occur in the Indo-Chinese subregion as far south as

Rangoon in Burma, Thailand, Combodia and Vietnam, Smith (*op. cit.*) also states that 'it has not been met with in north-eastern plateau-land of Thailand or in other parts of French Indo-China'. Hence, the aforesaid species constitutes the first authentic record from the Dun Valley in U.P. and thereby it extends the known range of its distribution in northern India as far as the Dun Valley and thus it closely bridges the gap between the Ganga Valley of Patna (Bihar) and Dehra Dun.

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Result of Lion Census—12th to 17th May 1979

(by direct visual count)

S.No.	Name of Range	No. of adult lions		No. of Subadult lions		No. of cubs	Total
		Male	Female	Male	female		
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
1.	Sasan	11	26	7	6	34	84 (88)
2.	Visavadar	6	14	2	1	9	32 (22)
3.	Jamwala	9	9	—	2	8	28 (31)
4.	Chhodavdi	10	8	3	4	—	25 (10)
5.	Jasadhar	14	5	1	—	—	20 (12)
6.	Hadala	1	5	—	—	7	13 (Nil)
7.	Sarasiya	1	1	—	1	—	3 (2)
8.	Dungar (Girnar)	—	—	—	—	—	— (2)
9.	Mitiyala	—	—	—	—	—	— (Nil)
Total		52 (39)	68 (48)	13 (13)	14 (25)	58 (42)	205 (167) i.e. nett increase of 38 lions (about 23%)

(Note:— Figures in brackets are corresponding ones for 1974 census given for purpose of comparison.)

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Lion mortality figures from May, 1974 to May, 1979

	Male	Female	Cubs	Total
Natural deaths	—	5	5	10
Accidental deaths	4	3	2	9
Due to foul play	5	2	5	12
Total	9	10	12	31

To this may be added another 9 lions (4 males + 1 female + 4 cubs) which were captured and removed to Sakkarbagh Zoo, Junagadh, for treatment, thus bringing the total reduction in the lion population between the two censuses to 40.

Taking this mortality into consideration, the overall increase in lion population from 1974 to 1979 comes to 78 (40 + 38) which works out to an average increase of about 15 lions per year.

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Statement

Statement showing the animals other than lions counted on the water holes on 12th-13th May, 1979, in the census of Wildlife in Gir and adjoining areas.

Name of the Zones	Panther	Hyaena	Spotted Deer	Sambar	Blue-bull (nilgai)	Wild boar	Four-horned Antelope	Chin-kara	Monkey
1. Jasadhar	49	28	981	65	663	517	388	242	1167
2. Jamwala	32	10	2482	274	651	588	240	29	1967
3. Sarasaiya	20	6	390	68	182	262	75	12	350
4. Kankai	13	9	1762	63	211	154	182	19	713
5. Sasan	25	4	2736	194	235	342	147	10	1165
6. Devaliya	7	6	80	—	18	137	10	7	105
7. Girnar	13	17	—	96	68	365	—	11	1428
8. Mitiyala	2	4	—	—	8	—	—	—	—
TOTAL	161	84	8431	760	2036	2365	1042	330	6895
1974 Census figures	(155)	(71)	(4517)	(706)	(1528)	(1922)	(969)	(195)	(3938)

M.A. Rashid

for Addl. Chief Conservator of Forests
(Wildlife), Gujarat State.

The Core Areas of Project Tiger

By

ZAFAR FATEHALLY

For several decades a discussion has gone on amongst wildlife biologists about the extent to which wild animals object to the presence of humans and cattle in their habitat. Some have argued that natural conditions are essential for the flowering of wildlife to its full potential. Every species of life is attuned to a specific environment it is said, and if the flora or the fauna of the locality is altered even minimally this affects their life style from many angles. On the other hand some foresters have claimed that wild animals soon get used to human presence and that such activities like selective felling within Sanctuaries and a judicious exploitation of the habitat in no way affects the population or its quality. Some go further and say that the canopy of the densely forested areas needs to be opened up so as to provide adequate browse and graze for wildlife.

I cannot claim to have any specific knowledge on this subject but it does seem odd that in a place like Bandipur and Topslip much of the wildlife is concentrated around the Tourist Complexes where the tree cover is limited and where of course there is considerable human activity.

However, believing in the principle that nature must be left completely alone to find its own balance the Steering Committee of Project Tiger recommended that a Core Area free from any kind of human exploitation should be established within every Tiger Reserve, and the then Prime Minister insisted at the time when the Project was initiated, that unless the State Governments accepted the principle of the Core the Project would not be sanctioned as a centrally sponsored scheme. After some hesitation this undertaking was given by the States.

But the State Governments, atleast some of them, continue to nurse a grievance against the imposition of this condition, as they have to forgo considerable revenue as a result of the moratorium on forest exploitation. If a decision had not been taken to continue Project Tiger in the VIth 5 year plan, many of the States would have reverted to exploiting the Core Areas of these Reserves.

Five years is too short a period to assess the effects of total protection on an area as against its partial exploitation. But it may be worthwhile at this point to discuss whether there is any indication that the ecological qualities of the environment have been enhanced as a result of this policy. What follows is largely based on the replies which I received from the Field Directors and knowledgeable conservationists in response to my queries on this subject and on my brief visits to some of the Reserves. Though the information is sketchy and of no great significance, it is presented nevertheless in the hope that others will build upon it and that a continuing record will be maintained not merely of the floral and

faunal changes within these totally protected pockets but an attempt made to take an integrated look at these Cores in relation to their comparatively less protected surroundings.

I wrote to all the Field Directors asking for information about the principle vegetation, the changes that were noticeable as a result of protection, the economic loss to the State by non-exploitation of forest produce, and I went on to say; "It has been the view of ecologists that when nature is left to its own devices, totally free from human interference, it finds its own balance, presumably attaining its highest productivity in the process. In this natural state every piece of land must perform its ecological function in an efficient manner, and one of these must be the maximum retention of soil water". I was particularly anxious to find out if there was any noticeable change in the water regime.

Palamau

The Reserve is bordered by the Koel river and its numerous tributaries provide sustenance to the area. The Sal (*Shorea robusta*) that beautiful tree of north India, together with Terminalias and Bamboo dominate many areas of the Park, and provide suitable conditions for a wide range of animals and birds. Like most other forested areas of India, Palamau too was 'worked' by the Forest Department for extracting timber, bamboo, grass and minor forest products of various kinds. The Field Director Shri J.N. Sinha said that cattle from the neighbouring village as well as from villages inside the Reserve used to graze freely and under these circumstances, wildlife, in the words of the previous Chief Conservator of Forests, was pushed to the wall. If it survived well and good, but priorities were given to revenue collecting activities and human exploitation of the habitat proceeded apace. Graziers set fire to the grass to induce a fresh flush before its time in the interest of their cattle; the soil building litter and humus under the trees on the ground was also burnt and the soil deteriorated from year to year. With the soil bared of vegetation cover, the heavy monsoon showers instead of percolating into the ground and recharging ground water aquifers stormed down to low lying regions taking the soil with them. Altogether the area was degenerating to one of low productivity, and was in the state of regression ecologically speaking.

Then from April 1972 there was a change. The Management Plan of the Palamau Tiger Reserve reversed the priorities. A core area of almost 300 sq. kms was established where no exploitation of any kind was to be permitted and in the rest of the area too only a minimum of tourism and human use was allowed. The results have been spectacular. When you visit the core area you find lush grass carpeting the ground. The streams which flow are clear and the check-dams created to reduce the pace of the streams and to retain water have resulted in just two years in the astonishing situation that seasonal streams which used to dry up by November now continue to flow till the end of February.

All in all conditions have improved dramatically, and it is hoped that in course of time there will be perennial grass cover throughout the year and wildlife saved from starvation. As soon as you leave the core you notice the difference. The ground cover consists of woods rather than palatable species of grass; the trees and shrubs appear to be less vigorous and the landscape has the familiar look of over use with nature never given a chance to recoup its resources. The effect of total protection on the core areas of Tiger Reserves should be a pointer to our planners. India can become a highly productive country in terms of forage and fodder resources if scientific land use plans are formulated and implemented for all the Districts of our country.

Kanha (Madhya Pradesh)

The area of the Kanha Tiger Reserve is 1945 sq kms. of which the Core is 940 sq.kms. Hence the Core Area amounts to as much as 48% of the total area. The annual rainfall is 1600 mm or approximately 64 inches and the forests of the Core come within the moist deciduous belt. The main ridge which traverses the area has extensive plateaus on the top with steep upper slopes and sprawling lower ones. The plateaus have little tree growth, and such trees as exist, are of miscellaneous deciduous species. The upper slopes have a certain amount of Bamboo which become fairly prominent in the lower and middle reaches. In the valley bottoms and its surroundings the stately sal is the dominating tree. A feature of Kanha is that both on the high ground as well as in the valleys there are extensive grassy maidans which probably owe their origin to cultivation in the past. Since these maidans have great attraction for wildlife it is clear that human activity in the past has not degraded, but has actually enhanced the quality of the environment as far as wildlife is concerned.

As a result of the stopping of grazing and better fire protection there has been noticeable improvement in the vegetation. The growth is considerably larger than in the past and there appears to be a greater variety as far as the ground flora is concerned. A significant result of this fire protection pointed out by the Field Director is the slow advance of tree species on the maidans. This trend will have to be carefully watched if the integrity of the maidan is to be maintained, otherwise in a few decades the open meadows will be covered up by trees.

It has been stressed by animal ecologists that wildlife do far less damage to the range than domestic cattle and the Field Director commenting on this says "the productivity of grasslands...is far higher when the wild herbivores use them as compared to when the users are domestic cattle, inspite of the fact that the cattle biomass is lower". The principles of selective feeding by different species of wildlife obviously accounts for this situation.

The annual loss of revenue to the State as a result of stopping forest exploitation in the Core is approximately 60 lakhs of rupees.

Melghat (Maharashtra)

The area of the Melghat Tiger Reserve is 1571 sq kms of which 301 sq kms is demarcated as the Core. The forests of the Core consist of deciduous trees with Teak (*Tectona grandis*) predominating. The associates of the Teak are Haldu (*Adina cordifolia*), Dhaora (*Anogeissus latifolia*), and Saj (*Terminalia tomentosa*). Much of the area belongs to the dry deciduous teak forests as per the classification by Champion and Seth. There are three sub types which occupy small areas of the Core and the main species here are (1) Tiwas forests preponderating in *Ougenis cogeinensis* (2) Mixed forests composed of species like tiwas, dhaman (*Grewia tilasfolia*), Meyen (*Lannea coromandelica*), Salai (*Boswellia serrata*), Saj (*Terminalia tomentosa*) and Bamboo (*Dendrocalamus strictus*). The bamboo understorey forms an extremely dense complex and provides the type of habitat which tigers are known to favour. Unfortunately one of the limiting factors of Melghat is the lack of water during the long dry summer. Though it receives substantial rainfall of about 1600 mm per year, between June and September, the nature of the soil and the sub-strata is such that water drains away quickly and nothing is retained for the summer months when the temperature sometimes reaches 46°C. Perhaps it is because of this, that in this comparatively large Reserve, the census in 1972 indicated the presence of only 32 tigers.

As yet nothing of special significance can be noticed about the Core Area.

According to the Field Director Shri K.A. Shaikh the Core Area even before it came under Project Tiger was subjected to minimum exploitation mainly because of inaccessibility and paucity of labour. There was not a single village in the area at the time. The Field Director says, quite rightly, that since this environment was so well protected over the ages it is difficult to spell out the change that has taken place during the last 5 years, because there has been no alteration in the conditions obtaining over the previous decades.

The State has lost Rs. 25,00,000 in revenue because of stopping of forestry operations in the Tiger Reserve.

Similipal (Orissa)

The Similipal Tiger Reserve consists of 2750 sq km of which the Core Area is almost of the same size as of Melghat, 303 sq kms. But in contrast of Melghat, in the words of the Field Director Shri Saroj Choudhury "It is a land of perennial water, in myriad streams and meandering rivers, with gorgeous falls, cascading rapids and deep lolling pools. Here lies pristine wilderness in a far spread expanse of unspoilt natural beauty".

To my query about the changes that have taken place in the Core Area since total protection was enforced 5 years ago Saroj Choudhury says "The most significant change which is apparent, is the greenness of the cover during the summer and that only because

of strict fire protection. Such salubrious conditions naturally promotes influx of wild animals from fire razed floors of the surrounding buffer. Dispersal takes place again with the onset of the monsoon. Except during the summer there is as yet no marked difference in the stands and the looks of the existing forests in the core and in the buffer. Five years is too short a period to provide an objective report”.

Periyar (Kerala)

As is well known the Periyar Sanctuary is a remarkable example where a hydro-electric project was carefully designed to enhance rather than to destroy the qualities of the natural environment. The total area of the Reserve is 777 sq kms of which the Core is 350 sq. kms.

Replying to my queries, Shri K.K. Nair, the CCF of Kerala, said that no forestry operations were carried out in this Reserve for revenue before the implementation of Project Tiger and hence there is no economic loss to the State as a result of the Project being initiated. Obviously since this Tiger Reserve has just been designated no comments can be made about the physical effects of total protection of the Core Area.

The principal vegetation of the Core Area falls under evergreen and deciduous forest types. The dominant species in the deciduous forests are *Tectona grandis*, *Lagerstroemia*, *Terminalias*, and *Pterocarpus marsupium*. The dominant trees in the evergreen forests and semi-evergreen forests are *Vateria indica*, *Palaequium elipcum*, *Salmalia malabricum*, and *Dalbergia latifolia*.

Sundarbans

The area of the Sundarbans Reserve is 2585 sq kms of which the Core is 1330 sq kms which amounts to 51% of the area of the Reserve. The principal vegetation consists of *Cereop roxburghiana* and two other species of Cereops, *Excrescaria agallocha* (Genwa), *Sonneratia apetala* (Keora), *Phoenix paludose* (Hental), *Nipa fruticans* (Golpara) etc. No significant changes have been noticed in the quality of the vegetation in the past five years since the Project was started.

As far as the animals are concerned they seem to have become less shy presumably because poaching has been contained and large herds of spotted deer are found where none were seen before. With regard to the tigers the Field Director, Shri K. Chakreverty suggests that they have moved out of the Core Area into the Buffer Zone where more human food is available. Attacks on humans in the Buffer Zone have increased, although the total human casualties per year have been reduced.

The annual loss of revenue to the State as a result of cessation of exploitation is approximately 6 lakhs of rupees per year.

Bandipur

The Bandipur Tiger Reserve has an extant of 689 sq.kms. and the Core Area consists of 354 sq.kms. The Core abuts on the Wynad Wildlife Sanctuary of Kerala and the Mudumalai Wildlife Sanctuary of Tamil Nadu.

Several steps have been taken to maintain the integrity of the Core Area. Cattle are not allowed to graze in the Core, although they continue to graze along the border areas of the Reserve in Karnataka.

It is well known that incidents of poaching are high in the areas adjoining the Wynad border, and this can be brought under control only with the active collaboration of the Kerala Forest Department. Honey collecting tribals continue to camp in the Core Area of the Reserve during the honey season which is after the rains. Also rather unfortunately, the Core Area continues to be the thoroughfare of Sandalwood smugglers from Kerala. This undesirable activity can be checked only if there is considerable patrolling on foot by the Forest Department guards but there are presumably not enough guards to cover the area concerned. The provision of ponies for the Guards as suggested in a meeting of the Steering Committee should be explored.

Forest fires which are deliberately set by tribals do considerable damage to the vegetation and presumably to wildlife as well. Except in the summer of 1977 when there was excellent fire control in all the other years between 1973 till 1978 when the area has been under observation by several researchers fire has been a serious depletive factor in the Core Area.

In spite of the fire however the vegetation regeneration and the density of trees is noticeably higher in the Core than in the periphery.

It is surprising however that the population of herbivores is considerably higher in areas close to the Tourist Complex in Bandipur than in the wilderness zone. This is due to the presence of the open glades which provide excellent grazing and patches of lantana and scrub jungle which is a very suitable habitat for fawning as well as for the survival of fawns. There is also the advantage that there are perennial water pools in this area.

The scarcity of water in summer is still a problem in the Core Area. For animals living close to Kakkanahalla particularly this is a severe drawback and this accounts for their absence from here in the months of March and April. The proposal to build a dam across the stream at Kakkanahalla should be carried out quickly. This will have to be a joint venture between the Tamil Nadu and the Karnataka Governments.

It might be noted that the burnt area of the Core, after the arrival of the rains and the growth of fresh grass attracts large numbers of sambar and gaur. They do not seem to be too fond of areas with unburnt mature grass.

Conservation of Swamp Forests for Wildlife

By

SOM DEVA, M.M. SRIVASTAVA AND GHAN SHYAM.

Department of Botany, D.A.V. Post-Graduate College, Dehra Dun, India

Tropical swamp forests once formed an important part of vegetation and extended all along the base of Himalaya from Assam to Peshawar in Pakistan. The heavy rainfall annually in the mountains percolated deeper into the soil and reappeared in form of hundreds and thousands of artesian springs and streams at their base creating a water-logged soil which supported a very special type of flora. It formed an almost continuous evergreen belt of forests, providing a refuge to many animals and great herds of elephants, rhinoceros, wild buffaloes, swamp deers and many others including many Carnivores existed in perfect ecological harmony. Human civilization as started developing first slowly, then fast and faster, these swamp forests started disappearing. Babar shot a rhino at Peshawar in the year 1525 (Thakur, 1968) and by the middle of 20th Century, 425 years later, only a small herd of *Rhino* numbering about two to three hundred is waiting at the farthest end of the swamp vegetation at Kajiranga in Assam, to finally disappear. By the time the Britishers in 1816, established their firm rule occupying the Himalayan foot belt, all swamp vegetation west of river Yamuna had completely disappeared and the herds of animals had withdrawn further east of Ganga in absence of proper feeding grounds. The developing human population and the hunger for land made further inroads and the destruction of swamp forests further increased. The rich and fertile soil where they grew, was developed for agriculture. Sir G. King (1871), who prepared the report for the development of forests in Dehra Dun recommended, the clearing and draining off these swamps as economically poor timber grows there and create a highly malarious climate. By the year 1911 Walton recorded in the District Gazetteers, that ".....the wide swamps which covered once Pargana Eastern Dun have entirely disappeared except near the confluence of the Suswa, the Song and the Jakhan, and in the riverine delta between Raiwala and Rishikesh near the Ganges. The climate has greatly improved with the draining off of the swamps and thinning of the forests". The evergreen belt of swamp forest along the Himalayan base was now broken. The swamps exist in patches, some times hundreds of miles away from the next, thus sealing off the migratory passages and trapping the herds making them easy targets for 'Bara' and 'Chota' Sahibs who collected trophies in great number for decorating their drawing rooms in Europe. The conservation movement of the Ecologists was far away to come and many animal species dwindled and vanished.

These swamp forests now in patches, however continued to support the special type of flora, though discontinuously distributed. Then came the independence of the country along

with the great refugee influx. More land was needed and the axe fell further and many more remaining swamps were cleared by clear felling and draining off all along the foot of Himalaya from Dehra Dun to Kashipur and Nanital in U.P. and further east in Bengal and Assam. The modern medicines and insecticides had conquered the malaria and the dreaded swamps, no longer terrified humans, they entered deep and deeper cutting and lopping whatever was left. The special type of flora started vanishing. Kanjilal in 1901 visited these forests in Dehra Dun valley and focussed attention on great Botanical interest present in them. About Mothronwala, a swamp which existed near the Clement town, he recorded "as one draws nearer and one sees through the straight trunk of the Sal the deep green foliage of Ban Oak (*Quercus incana*) the tree finding the cold clayey soil and moist damp shade of the narrow ravines factors of locality somewhat similar to the prevailing in its proper habitat in the hills." Many other plants which are found commonly at higher altitude in Himalaya such as *Acer oblongum*; *Hadara halix*; *Symplocos cragoides*; *Olea glandulifera*, etc. were found commonly growing. A survey conducted of Mothronwala swamp 73 years later by Som Deva and Aswal (1974) found the forest completely finished and many of the trees earlier described by Kanjilal (1901) were now absent or were represented by stumps (Table 1, and Photograph No. I).

Table 1
Plants reported by Kanjilal now absent

Name of Plants	Kanjilal 1901	Som Deva & Aswal 1974
<i>Acer oblongum</i> Wall ex DC.	Present	Present (Stump)
<i>Itea nutans</i> Royle	Present	Absent
<i>Hedera nepalensis</i> Koch	Present	Absent
<i>Symplocos crataegoides</i> Ham.	Present	Absent
<i>Olea glandulifera</i> Wall ex Brandis	Present	Absent
<i>Linociera intermedia</i> Sw.	Present	Absent
<i>Persea duthiei</i> (King ex. Hook. f.) Pxa & Hoffm.	Present	Absent
<i>Neolitsea cuipala</i> (D. Don) Kosterm.	Present	Absent
<i>Drypetes assamica</i> (Hook. f.) Pax & Hoffm.	Present	Absent
<i>Quercus incana</i> Roxb.	Present	Present (Stump)
<i>Albizia chniensis</i> (Osbek) Merr	Present	Absent

About another swamp in Dehra Dun valley, Kanjilal (1901) mentioned Khiri situated between Raiwala and Rishikesh and said "..... in respect of grandeur of forest, this exceeds by far the other swampy areas (Photo. No. 2)." Som Deva and Srivastava (1978) found that most of the area between Raiwala and Rishikesh has been cleared of the swamp forests and a small section about 2 Km.² is now left in Golatappar 7 B block in Barkot range near the village Chhiddarwala. It was found in better stage of preservation, though the trees are being heavily lopped for fodder and fuel by nearby villagers. Many plants of a vanishing flora from the valley such as *Acinthocephalus indicus*, *Carallia brachiata*, *Cyclostemon assamicus*, *Ficus pomifera*, *Trema orientalis* etc. were found still present. Several plant new to the valley including and interesting orchid *Tropidia cuculigoides* (Som Deva and Arora, 1971), which is normally found as an under growth of evergreen rain forests in Assam, were also recorded. In a note in the register of the forest rest house at Golatappar, the senior author, where he had seen a large number of entries mentioning the size of the tigers those have been shot, wrote "collected to day.....plants new to the flora of valley from the swamp forest. Please stop the destruction, they may soon also meet the same fate of tiger and vanish".

Very few swamp forests are left now. Champion and Seth (1968) also agree ".....most of it has been cleared and drained off for agriculture, (Photo No. 3)." Whatever is left if not given a protection will finish and along with it a rare flora and few endangered animal species like Swamp deer (*Cervus duvaucels*) and Python (*Boa boa*) which still persist may vanish. Forest department has been giving, even now, low priority for protection and development to this special type vegetation. It is being appealed to the government to awaken before it is too late. It is needless to emphasise the importance of conservation, a type once lost can never be recreated. The human interference has already deflected much of the vegetation and reversed the process of succession. The following remedial methods as suggested may help to retrieve the situation to some extent and to provide protection to this rare and unique vegetation.

(a) Government and private agencies to survey and locate all along the Himalayan base such areas, which are still left. Air photographic survey methods can help in interpreting these evergreen patches in otherwise deciduous or semi-deciduous forests which usually surround them.

(b) Taxonomists, both of plants and animals to make collection and inventory and to locate plants and animals which still survive and focus attention on providing them protection.

(c) Ecologists to map the vegetation and location in detail to provide a clue for laying down the future policy and technique for their protection. They can also help in assessing

the damages already caused by human interference and suggest the methods to correct the process of succession.

(d) Finally the forest department is most important link and owner of these areas. They can help in providing complete protection from extraction, destruction, cutting and lopping if necessary by making strict laws and giving heavy punishments to poachers.

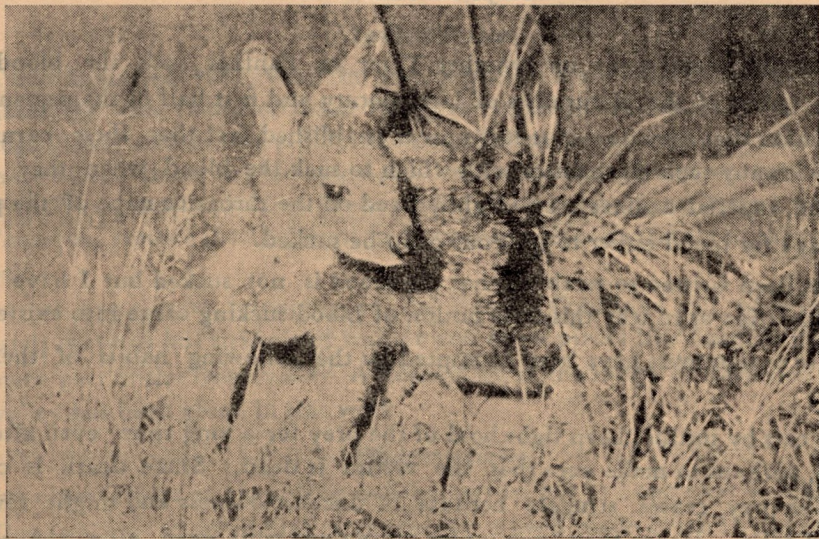
Creation of a public opinion especially of the persons living in these areas to protect their national heritage and to keep these left over areas for posterity to see what was it like.

We are highly indebted to Prof. R.P. Bhatnagar who went along with us on several occasions often wading in knee deep water to make a photographic records.

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Musk Deer Breeds in Captivity



musk deer

A fawn was born to a musk deer female on 17.6.1979 in Musk Deer Breeding Farm at Kufri (Simla). The fawn weighed 970 grams at the time of birth.

This is second time that breeding of musk deer has taken place in this farm. Previously 2 fawns were born in the year 1970 but unfortunately both the mother and the fawns died soon after birth.

Origin of The False Notion

By

RAJA H. TEHSIN

Much ink has been spent on whether Tiger or Panther suck the blood of their victims or not. Most of the Naturalists of last century and first half of the present century were of the opinion that they do. But it is now a established fact that these carnivores are not equipped with any such mechanism with which to suck the blood when they kill their prey. The solid, tapered canines are so tightly fixed on the throat or nape of the prey that there is no escape for blood either to spill out or to be sucked.

A lot has been written to establish that the blood is not sucked but I have not come across any explanation as to why this false notion of blood sucking came into existence.

This false notion must have been prompted by the following habits of these carnivores.

1. These cats by instinct keep tight hold of the prey for a long time even after all the struggle ceases, perhaps to make sure that the victim is dead. Since death is caused by strangulation the prey ceases struggle because of unconsciousness and might revive if the grip is released early. Hence they hang on for quite some time even after the struggle is over. This long grip must have made some naturalists to believe that the beast is sucking blood.

2. When the prey is being gripped for a long time under the force of two jaws it is natural that speedy salivation takes place in the mouth of the killer and when this excess saliva is being gulped by the beast it gives a false impression to the observer that blood is being sucked and gulped.

3. In stocking prey these cats spend lot of their energy and lose good amount of body fluid by way of perspiration. Once the prey is killed he gets the mental satisfaction of having secured his food and his thirst overpowers his hunger and he invariably leaves the kill at a secure place and goes to quench his thirst or for a rest. This habit made some of the naturalists to conclude that after sucking blood the beast has satisfied his hunger for the time being and went off.

4. Lastly a tiger or panther normally does not devour its kill immediately after killing it, perhaps to allow decomposition to set in. Since high meat is softer to tear. Hence this delay is not because the beast has satisfied his hunger by sucking blood.

Taxonomic Account and Field Observations on the Biology of *Nemachilus rupicola* (McClelland) in Doon Valley

By

S.P. GROVER

Lecturer in Zoology, D.A.V. (P.G.) College, Dehra Dun, U.P. INDIA.

Introduction

Hora and Mukerjee (1936) were the first to publish a systematic list of fishes of Doon valley. Later the fish fauna of Doon Valley attracted the attention of Lal and Chatterjee (1962). Singh (1964) and Grover (1970) who contributed only in giving the systematic list of some more fishes. However, biological studies remained neglected except for the work of Grover (1971,79) on *Barilius bendelsis* Ham. and on *Puntius ticto* Ham. Present investigation on the fish *Nemachilus rupicola* (McClelland) in Doon valley is undertaken to study its taxonomy and biology.

There are five species belonging to the family Cobitidae out of which *N. rupicola* (McClelland) occur in fast streams of Raipur and other places like Lacchiwala, Raiwala etc. in the eastern part of the Doon valley. A description of the range of variation of the species in Doon valley has been given in this work.

Observations

Present observations on the fish have been carried out in Song river at Lacchiwala in the Eastern Doon valley. Field studies on the fish have been made every 15 days for five years.

Taxonomic Account

The fish in my collection varies in length from 6.2 cms to 6.5 cms. Body elongated; ventral contour horizontal and the dorsal one more arched. Abdomen—rounded. Height of body is 17.1% (12.5% to 18%) in total length. Mouth subterminal with a small cleft. The fish has 3 pairs of barbels. Diameter of the eye 18.1% in length of head. Minute scales present on the posterior half of the body. Dorsal fin arises between the nostrils and the base of caudal fin. Pectoral extends more than half the distance to the ventral fin. Caudal fin emarginate. Lateral line complete. Colour yellowish with 13 vertical brown bands, narrower than the intermediate ground colour; wide dark, stripe across the base of the caudal and dorsal fin. Dorsal and caudal fins also bear several rows of spots forming stripes. A dark mark at the base of a few anterior dorsal rays (Fig.1).

Fin Formula D_9 (2/7). P. 10. V_8 A.₇ (2/5). C.₁₈

Habit and Habitat

The fish groundlings are sensitive to green water (infested with heavy algal growth). They are gregarious in nature. The species is a bottom dweller and is adapted to rapid water currents. It leads a hidden life under the stones.

Feeding Habits

Quantitative estimation of food was made by Pearse's (1915) method. It is a bottom feeder and carnivorous in nature and searches out dead food from the bottom mainly with the help of its barbules. The fish chews constantly at the bottom, bigger bites are fragmented in mouth and detritus being discharged through operculum.

Breeding Habits

The spawning period is from April to June. The fish breeds during the dusk or dawn. No mating games have been observed. The spawn adheres to stones and plants in shallow areas of the river. The parent fish leaves the spawning site. The fry feed on infusoria and microfood.

All these features related to biology are in accordance with *N. botia* (Ham. Buch.) and *N. savona* (Ham. Buch.).

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Fauna of Corbett National Park

(Continued from Cheetal, Vol. XX, No. 4, June 1979)

By B.S. LAMBA AND R.K. BHATNAGAR

500. *Zosterops palpebrosa palpebrosa* (Temminck) : Indian White-Eye.
Family : Ploceidae : Weaver Birds
501. *Passer domesticus indicus* Jardine & Selby : Indian House Sparrow.
502. *Passer rutilans cinnamomeus* (Gould) : Himalayan Cinnamon Tree Sparrow.
503. *Petronia xanthocollis xanthocollis* (Burton) : Indian Yellowthroated Sparrow.
504. *Ploceus philippinus philippinus* (Linnaeus) : Indian Baya.
505. *Ploceus megarhynchus megarhynchus* Hume : Finn's Baya.
506. *Ploceus benghalensis* (Linnaeus) : Blackthroated Weaverbird.
507. *Ploceus manyar flaviceps* Lesson : Indian Streaked Weaver Bird.
508. *Estrilda amandava amandava* (Linnaeus) : Red Munia or Avadavat.
509. *Lonchura malabarica malabarica* (Linnaeus) : Whitethroated Munia.
510. *Lonchura punctulata punctulata* (Linnaeus) : Indian Spotted Munia.
511. *Lonchura malacca rubroniger* (Hodgson) : Nepal Blackheaded Munia.

Family : Fringillidae : Finches

512. *Mycerobas icteroides* (Vigors) : Black-and-Yellow Grosbeak.
513. *Mycerobas affinis* (Blyth) : Allied Grosbeak.
514. *Carduelis carduelis caniceps* Vigors : Greyheaded Goldfinch.
515. *Carduelis spinoides spinoides* Vigors : Himalayan Green-finch.
516. *Callacanthus burtoni* (Gould) : Redbrowed Finch.
517. *Carpodacus erythrinus roseatus* (Blyth) : Indian Rosefinch.
518. *Carpodacus nipalensis kangrae* (Whistler) : Garhwal Dark Rosefinch.
519. *Carpodacus rhodochrous* (Vigors) : Pinkbrowed Rosefinch.
520. *Carpodacus rhodochlamys grandis* Blyth : Redmantled Rosefinch.
521. *Carpodacus rhodopeplus rhodopeplus* (Vigors) : Spottedwinged Rosefinch.
522. *Carpodacus thura blythi* (Biddulph) : Kashmir Whitebrowed Rosefinch.

Family : Emberizidae : Buntings

523. *Emberiza leucocephala leucocephala* S.G. Gmelin : Pine Bunting.
524. *Emberiza stewarti* (Blyth) : Whitecapped Bunting.
525. *Emberiza stewarti* (Blyth) : Whitecapped Bunting.

3. REPTILES

By

R.N. CHOPRA

A. SNAKES

- | | | | | |
|------|--------------------------------|---|-----------------------------|---------------------|
| I. | Family | : | Typhlopidae | Common Name |
| 1. | <i>Typhlops porrectus</i> | | Stoliczka | Blind Snake |
| II. | Family | : | Boidae | |
| 2. | <i>Python molurus</i> | | (Linn.) | Indian Python |
| 3. | <i>Eryx conicus</i> | | (Schneider) | Common earth Snake |
| 4. | <i>Eryx johi johi</i> | | (Russell) | Black earth Boa |
| III. | Family | : | Colubridae | |
| 5. | <i>Elaphe helena</i> | | (Daudin) | Trinket Snake |
| 6. | <i>Elaphe hodgsoni</i> | | (Gunther) | Trinket Snake |
| 7. | <i>Ptyas mucosus</i> | | (Linn.) | Rat Snake |
| 8. | <i>Coluber ventromaculatus</i> | | Gray and Racer
Hardwicke | |
| 9. | <i>Coluber rhodorhachis</i> | | (Boulenger) | |
| 10. | <i>Lycodon mackinnoni</i> | | Wall. | Wolf Snake |
| 11. | <i>Natrix stolata</i> | | (Linn.) | |
| 12. | <i>Trachisohium leave</i> | | Perracca | |
| 13. | <i>Bioga trigonata</i> | | (Schneider) | Indian Gamma |
| 14. | <i>Bioga multifasciata</i> | | (Blyth) | Himalayan Cat Snake |
| IV. | Family | : | Elapidae | |
| 15. | <i>Bungarus fasciatus</i> | | (Schneider) | Banded Krait |
| 16. | <i>Bungarus coeruleus</i> | | (Schneider) | The common Krait |
| 17. | <i>Naja naja</i> | | (Linn.) | Indian Cobra |
| 18. | <i>N. hannah</i> | | (Cantor) | King Cobra |
| V. | Family | : | Viperidae | |
| 19. | <i>Vipera ruselli</i> | | (Shaw) | Russells Viper |
| 20. | <i>Echis carinatus</i> | | (Schneider) | Phoorsa |

B. LIZARDS

- | | | | | |
|----|---------------------------------|---|------------|------------------------|
| I. | Family | : | Gekkonidae | |
| 1. | <i>Gymnodactylus lawderanus</i> | | Stoliczka | |
| 2. | <i>G. fasciolatus</i> | | (Blyth) | |
| 3. | <i>Hemidactylus brooki</i> | | Gray | |
| 4. | <i>H. flaviviridis</i> | | Ruppell | The Indian House-Gecko |

II. Family : Agamidae

5. *Japalura kumaonensis* (Annandale)6. *Calotes versicolor* (Daudin)

The Blood-sucker

7. *Agama tuberculata* Gray

The Roc-lizard

III. Family : Schnecidae. (The Skinks)

8. *Leiopisma himalayanum* (Gunther)9. *Riopa punctata* (Gmelin)

IV. Family : Varanidae

10. *Varanus monitor* (Linn.)

The Common Indian Monitor

V. Family : Crocodilidae

11. *Gavialis gangeticus* (Gmelin)12. *Crocodylus palustris* Lesson

Crocodile

4. AMPHIBIA

By

R.N. CHOPRA

I. Family : Ranidae

1. *Rana cyanophlyctis* Schneider2. *Rana limnocharis* Weigmann3. *Rana breviceps* Schneider4. *Rana crassa* Jerdon

II. Family : Microhylidae

5. *Microhyla ornata* (Dumeril and Bibron)

III. Family : Bufonidae

6. *Bufo andersonnii* Boulenger7. *Bufo melanostictus* Schneider

5. FISH

By

AKHLAQ HUSAIN

(Husain, A., *Cheetal*, 17 (2) : 39-42, 1976)

Scientific Name

Vernacular Name

CLASS : Osteichthyes

ORDER : Cypriniformes (Carps and Loaches)

FAMILY : Cyprinidae (Carps)

1. *Barilius barna* Hamilton

Dhaur

2. *Barilius bendelisis* Hamilton

Dhaur

- | | | |
|-----|---|------------|
| 3. | <i>Barilius bola</i> Hamilton | "Trout" |
| 4. | <i>Barilius vagra</i> Hamilton | Dhaur |
| 5. | <i>Brachydanio rerio</i> (Hamilton) | |
| 6. | <i>Chagunius chaginio</i> (Hamilton) | |
| 7. | <i>Crossocheilus latius</i> (Hamilton) | Saknera |
| 8. | <i>Danio devario</i> Hamilton | |
| 9. | <i>Esomus danricus</i> (Hamilton) | |
| 10. | <i>Garra gotyla gotyla</i> (Gray) | Bhagnera |
| 11. | <i>Garra lamta</i> (Hamilton) | Bhagnera |
| 12. | <i>Labeo dero</i> (Hamilton) | Unera |
| 13. | <i>Puntius conchoni</i> (Hamilton) | Dumrua |
| 14. | <i>Puntius sophore</i> Hamilton | |
| 15. | <i>Puntius ticto</i> Hamilton | Dumrua |
| 16. | <i>Rasbora daniconius daniconius</i> (Hamilton) | |
| 17. | <i>Tor chilinoide</i> (Mc Clelland) | Karanchula |
| 18. | <i>Tor putitora</i> (Hamilton) | Mahseer |
| 19. | <i>Tor tor</i> (Hamilton) | Mahseer |

Family : Cobitidae (Loaches)

- | | | |
|-----|--|--------|
| 20. | <i>Lepidocephalus guntea</i> (Hamilton) | |
| 21. | <i>Noemacheilus</i> , sp. | Gadera |
| 22. | <i>Noemacheilus botia</i> (Hamilton) | Gadera |
| 23. | <i>Noemacheilus corica</i> (Hamilton) | Gadera |
| 24. | <i>Noemacheilus rupicola</i> (Mc Clelland) | Gadera |

ORDER : Siluriformes (Catfishes)

FAMILY : Amblycepididae

- | | | |
|-----|-------------------------------------|------|
| 25. | <i>Amblyceps mangois</i> (Hamilton) | Nain |
|-----|-------------------------------------|------|

FAMILY : Bagridae

- | | | |
|-----|--------------------------------|--|
| 26. | <i>Mystus vittatus</i> (Bloch) | |
|-----|--------------------------------|--|

FAMILY : Sisoridae Gonch

- | | | |
|-----|-------------------------------------|--|
| 27. | <i>Bagarius bagarius</i> (Hamilton) | |
|-----|-------------------------------------|--|

(To be continued)

Mathematical Theory to Study The Ecological Balance and Conjugation Principle of Wild Animals in Any Closed Environment

By

SASADHAR DE

Institute of Theoretical Physics, Bignan Kuthir, 4/1, Mohan Bagan Lane, Calcutta-4, (India)

Abstract : By the use of mathematical principles, we have studied here the ecological balance and biological symmetry (equilibrium) of wild animals in a reserve forest.

1. Introduction

A number of theories have been proposed to study the dynamics of ecology of wild animals. The author wants to present here some mathematical aspects of such dynamics. Some mathematical principles are formulated here with the construction of models. The discussion is confined to the closed environment.

2. Fundamental Concepts of Population Dynamics in a Reserve Forest

We consider N number of animals in any reserve environment. Let α denotes the specific birth rate and β the specific loss rate. Therefore, the rate of change of population is given by

$$\dot{N} = (\alpha - \beta) N, \quad (1)$$

from which we get

$$N_t = N_0 e^{(\alpha - \beta) t}, \quad (2)$$

N_0 is the population size of animals at time $t = 0$.

At time t_1 , we write $N(t_1) = N_0 e^{\nu t}$, ($\nu = \alpha - \beta$).

At this time, we suppose that N_0 is again kept in the environment. Therefore, at a very small time interval (δt), we have

$$N(t_1 + \delta t) = N_0 (1 + e^{\nu t}) \quad (3)$$

and the population after a second time interval is

$$N(t_2) = N_0 (1 + e^{\nu t}) e^{\nu t}. \quad (4)$$

We again introduce N_0 populations. Therefore, we have

$$\begin{aligned} N(t_2 + \delta t) &= N_0 (1 + e^{\nu t}) e^{\nu t} + N_0 \\ &= N_0 (1 + e^{\nu t} + e^{2\nu t}) \end{aligned} \quad (5)$$

In this way, after the n th year, the population will be

$$N(t_n) = N_0 (1 + e^{\nu t} + e^{2\nu t} + \dots + e^{(n-1)\nu t}). \quad (6)$$

From equations (2) and (6), we find that when the birth rate prevails, i.e., when $\alpha > \beta$, the population size of animals increases exponentially. When $\alpha < \beta$, the population size decreases, and the population will die out. For $\alpha = \beta$, the population will remain stable and is equal to nN_0 .

If the immigration of individuals at a constant rate is denoted by δ , the equation (1) can be rewritten as

$$\dot{N} = (\lambda - \mu) N + \delta. \quad (7)$$

Assuming like before that at $t = 0$, $N = N_0$, we have

$$N = N_0 e^{\nu t} + \frac{\delta}{\gamma} (e^{\nu t} - 1), \quad \lambda \neq \mu. \quad (8)$$

If, however, the rate of change of population is denoted by

$$\dot{N} = (a - \beta N), \quad (1a)$$

where a is the asymptotic size of the population, we have

$$N_t = \frac{1}{\beta} (a - b e^{-\beta t}), \quad b = \text{constant of integration.}$$

We can write simply the above expression as

$$N_t = C \left\{ 1 - e^{-\beta (t-t_0)} \right\}, \quad (8a)$$

where C is a constant and t_0 is the initial time.

2.1. Interaction of Animals

We consider a closed environment which contains three kinds of animals.

Let $x_1 = x_1(t)$, $x_2 = x_2(t)$ and $x_3 = x_3(t)$ be the number of individuals of the three species as a function of time. We assume that there is a constant birth and death rate so that the rate of change due to interaction is proportional to the size of the interfering population. In this case, we have

$$\begin{aligned} \dot{x}_1 &= a_1 x_1 + b_1 x_2 + c_1 x_3 \\ \dot{x}_2 &= a_2 x_1 + b_2 x_2 + c_2 x_3 \\ \dot{x}_3 &= a_3 x_1 + b_3 x_2 + c_3 x_3, \end{aligned} \quad (9)$$

where a_j are certain constants (positive, negative or zero).

Assuming $x_1 = A_1 e^{vt}$, a nontrivial solution is possible only if the characteristic equation

$$\begin{vmatrix} a_1 - \lambda & b_1 & c_1 \\ a_2 & b_2 - \lambda & c_2 \\ a_3 & b_3 & c_3 - \lambda \end{vmatrix} = 0 \quad (10)$$

holds. This is a cubic equation in λ . Let the roots λ_j ($j = 1, 2, 3$) are the eigen values of the systems.

Therefore, we have

$$\begin{aligned} x_1 &= \sum A_{1j} e^{\lambda_j t} \\ x_2 &= \sum A_{2j} e^{\lambda_j t} \\ x_3 &= \sum A_{3j} e^{\lambda_j t}, \quad j = 1, 2, 3 \end{aligned} \quad (11)$$

where λ_j are obtained from equation (10). If λ_j are positive, the ecological system will explode. The population will decrease if λ_j are negative. If, however, the roots are not real, the ecological system will oscillate. To show this in a simple way, we consider interaction between two animal species. In this case, we have

$$\begin{aligned} x_1 &= \sum A_{1s} e^{\lambda_s t} \\ x_2 &= \sum A_{2s} e^{\lambda_s t}, \quad (\lambda_1 \neq \lambda_2), \quad s = 1, 2, \end{aligned} \quad (11a)$$

$$\text{where } \lambda_{1,2} = \frac{(a_1 + b_2) \pm \sqrt{(a_1 + b_2)^2 - 4(a_1 b_2 - a_2 b_1)}}{2} \quad (12)$$

Therefore,

$$x_{1,2} = \exp(vt) \left(C_{1,2} e^{\omega_1 t} + D_{1,2} e^{-\omega_1 t} \right), \quad (13)$$

where

$$v = \frac{a_1 + b_2}{2}, \quad 4\omega_1^2 = (a_1 + b_2)^2 - 4(a_1 b_2 - a_2 b_1),$$

$$C_1 \equiv A_{11}, \quad D_1 \equiv A_{12}, \quad C_2 \equiv A_{21}, \quad D_2 \equiv A_{22}.$$

If $(a_1 + b_2)^2 < 4(a_1 b_2 - a_2 b_1)$, we have

$$\begin{aligned} x_{1,2} &= \exp(vt) (A_{1,2} \cos \omega t + B_{1,2} \sin \omega t), \quad \omega^2 = -\omega_1^2, \\ A_{1,2} \text{ and } B_{1,2} &\text{ are constants.} \end{aligned} \quad (14)$$

The equation (14) shows that the ecological system is oscillating. Again we have, as t increases $e^{-\omega_1 t}$ tends to zero and $e^{+\omega_1 t}$ tends to infinity. Hence $x_{1,2}$ both tend to $+\infty$ if $C_{1,2} > 0$ or to $-\infty$ if $C_{1,2} < 0$. In either case, the system $x_{1,2}$ is exploding.

3. Interaction and Conjugation Principles of Males and Females of Wild Animals

The above model can be utilized to study the interaction and conjugation principles of males and females of wild animals (say deer) which are kept in a reserve forest or national park. Let there be n number of females and m number of males. Again, let the number of dominating females be x and the other females (say, tender or very old) be x' so that $n = x + x'$. Similarly, if the number of dominating males be y and the other males be, y' we have $m = y + y'$. When the number of dominating male populations are less, there is possibility of less struggling for them for sexual interest. So in this case, fertilization may be smooth and the growth of the population size will continue and after a certain time interval, males and females and hence the dominating males and females will increase in number. When the number of dominating males are increased, there is possibility of maximum struggling for them. The males will now devote their maximum time to fighting. So, the rate of fertilization will decrease and the loss of dominating males will be increased. This loss is now equal to the normal death plus death due to illness for fighting, as they will not even get enough time to eat. The population size will decrease and the same operation will be repeated. The males generally exist at some fixed places of forests, where there is sufficient food and the females roam about those places in search of food. In this way, males and females come together (unite) and the sexual interest is performed. Thus, we have

$$\frac{dn}{dt} = \left\{ \begin{array}{l} \text{rate of change of non-} \\ \text{dominating females which} \\ \text{are not interested at all} \end{array} \right\} + \left\{ \begin{array}{l} \text{rate of change of dominat-} \\ \text{ing females in the absence} \\ \text{of conjugation} \end{array} \right\} + \left\{ \begin{array}{l} \text{rate of change due to} \\ \text{conjugation with the} \\ \text{dominating males} \end{array} \right\}$$

and

$$\frac{dm}{dt} = \left\{ \begin{array}{l} \text{rate of change of non-} \\ \text{dominating males which} \\ \text{are not interested at all} \end{array} \right\} + \left\{ \begin{array}{l} \text{rate of change of males} \\ \text{due to conjugation with} \\ \text{the dominating females} \end{array} \right\} + \left\{ \begin{array}{l} \text{rate of change of} \\ \text{males in the absence} \\ \text{of conjugation} \end{array} \right\}$$

We assume that in both the female and male populations, there is a constant birth and death rate.

In this case, we write

$$\frac{dn}{dt} = a_1 x' + b_1 x + c_1 y$$

$$\frac{dm}{dt} = a_2 y' + b_2 x + c_2 y, \quad (15)$$

where a_s , b_s and c_s are certain constants

(positive, negative or zero, $s = 1, 2$).

For simplicity, we assume

$$\begin{aligned} x' &= \alpha_1 x \\ \text{and } y' &= \beta_1 y, \end{aligned} \quad (16)$$

where α_1, β_1 are constants.

Using (15) and (16), we get

$$\frac{dx}{dt} = ax + by$$

$$\text{and } \frac{dy}{dt} = cx + dy, \quad (17)$$

where

$$a \equiv \frac{a_1 \alpha_1 + b_1}{1 + \alpha_1}, \quad b \equiv \frac{c_1}{1 + \alpha_1}, \quad c \equiv \frac{b_2}{1 + \beta_1}, \quad d \equiv \frac{a_2 \beta_1 + c_2}{1 + \beta_1}$$

The equations (17) resemble to the previous case. The ecological system will oscillate if $(a + d)^2 \leq 4(ad - bc)$.

3.1. Alternative Mathematical Approach to Study the Conjugation Phenomena

We simply write equations (15) as

$$\begin{aligned} \frac{dn}{dt} &= a_1 n + b_1 (m - y') \\ \text{and} \\ \frac{dm}{dt} &= a_2 (n - x') + b_2 m. \end{aligned} \quad (18)$$

Assuming

$$\begin{aligned} x' &= \alpha' n \\ \text{and} \\ y' &= \beta' m, \end{aligned} \quad (\alpha', \beta' \text{ are constants}) \quad (19)$$

the equations (18) will reduce to the form (17).

Again, if we write equations (15) in the form

$$\frac{dx'}{dt} = a_1 x', \quad \frac{dy'}{dt} = a_2 y' \quad (20)$$

and

$$\begin{aligned} \frac{dx}{dt} &= b_1 x + c_1 y \\ \frac{dy}{dt} &= b_2 x + c_2 y \end{aligned} \quad (21)$$

we have

$$\begin{aligned} x' &= x'_0 e^{(\lambda - \mu)t}, \quad y' = y'_0 e^{(\lambda' - \mu')t} \\ a_1 &\equiv (\lambda - \mu), \quad a_2 \equiv (\lambda' - \mu'), \end{aligned} \quad (22)$$

(x'_0, y'_0 stand for the population size of the non-dominating females and males respectively at time $t = 0$; λ, λ' are the specific birth rates and μ, μ' are the specific death rates). The equations (21) can be tackled exactly in the same way as given in the previous cases. So the female population size, $n = x + x'$ and the male population size, $m = y + y'$ can be studied. The values of the constants a_r, b_r and c_r will determine the biological equilibrium of the system.

4. Discussion

In nature, animals live in fluctuating temperatures. It has some influence on the study of population dynamics. It affects the duration of life, the speed of development, the fecundity and the behaviour of animals for conjugation. The amount of the pollutant in the environment also affects the population size. The rate of fertilization is also dependent on other factors for which it is difficult to do experiments.

Acknowledgement

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Tiger Census in Gujarat State — April, 1979

By

M.A. RASHID

Addl. Chief Conservator of Forests, (Wild Life), Gujarat State.

A census of tigers in Gujarat State was carried out from 15th to 21st April, 1979. A brief account of the same is given below:-

Initially, the following potential tiger areas of the State were proposed to be covered during the census:

Name of Circle	Name of Forest Division	Name of Range.
Surat	Dangs (North)	All Ranges
	Dangs (South)	-do-
	Valsad	Bansda (including the Bansda National Park area), Pangarbari and Fatepur.
	Vyara	Vajpur Range covering Satkashi forest.
	Rajpipla (West)	Mandvi (North) Mandvi (South)
	Rajpipla (East)	Dediapada, Fulsar, Piplod, Rajpipla, Sagbara.
Gandhinagar	Banaskantha	Danta and Ambaji

This census area covered a total of 275 beats, the beat being the territorial unit for the census.

Detailed cyclostyled instructions in vernacular on the census methodology were supplied to each Beat Guard. The period from 3rd to 5th April was earmarked for collecting preliminary census information so as to determine the areas where tigers or their signs were reported during the last 12 months. On the basis of this information, the final census was confined to the following areas:

Dangs (North) and Dangs (South) Divisions; Bansda Range of Vlsad Division; Rajpipla Range of Rajpipla (West) Division and Ambaji Range of Banaskantha Division.

Throughout the census week, each Beat Guard within the census area did intensive patrolling within his jurisdiction (with the help of hired trackers where necessary), specifically for the purpose of detecting signs and symptoms of tiger movement in his area (such as actual sighting, pugmarks, droppings, kills, etc.). Any positive reports received from them were immediately verified on the spot by a responsible officer (Range Forest Officer Asstt. Conservator of Forests or Dy Conservator of Forests). Wherever pugmarks were found they were recorded on a Tiger Tracer indicating the location and time. A blueprint showing the actual size sample of tiger pugmarks (male, female and cub) had been supplied to each Beat Guard for his guidance in the field and to eliminate the possibility of panther pugmarks being mistaken for tigers.

In all, 11 cases of direct or indirect tiger sightings were reported at the end of the census period from Dangs (North), Dangs (South) and Rajpipla (East) Divisions, of which only 7 were finally accepted as enumerated below:

Dangs (North) Division

- (1) One tigress reported from Bardipada Beat 2 (Census No. 8) of Bradipada Range. The presence of this tigress has been definitely confirmed both from her pugmark which has been duly recorded on the Tracer and her droppings which have been collected.
- (2) One tigress was reported from Bhujad Beat (Census No. 14) of Bheskatri Range. The presence of this tigress has been definitely confirmed from her pugmark which has been recorded on the Tracer at two places.

Alongwith the pugmark of this tigress a smaller pugmark which could possibly be of her cub has also been reported. However, as there is some element of doubt as to whether the smaller pugmark is of the tiger cub or a panther, the same has not been taken into consideration for the purpose of tiger census.

- (3) One male tiger was reported from Savarkhadi Beat No. 1 (Census No. 17). The presence of this tiger is definitely confirmed not only from his recorded pugmark but also by actual sighting by the Beat Guard. He was disturbed in his cave and rushed out with a roar.
- (4) One male tiger was reported from Sarvar Beat No. 2 (Census No. 22) of Kalibel Range. The pugmark of this tiger has been verified by me personally.
- (5) One male tiger was reported from Hindla beat (Census No. 33) of Piplaidevi Range. The presence of this tiger is definitely confirmed from its recorded pugmark and also from the carcass of a big cow killed by it.

(6) One tigress was reported from Bhavadi Beat (Censuse No. 64) of Chichinagavtha Range. The persence of this tigress is definitely confirmed from her clear and fresh pugmark which has been recorded on the Tracer.

Dangs (South) Division

(7) One male tiger was reported from Nogrihat (uppar Junaraj) in Rajpipla Range. The presence of this tiger has been definitely confirmed from his recorded pugmark.

In addition to the above, the following cases of tiger sightings have also been reported from Dangs (South) and Valsad Divisions, which have however not been included for the purpose of the census for want of positive and reliable verification:

(8) A set of pugmarks was recorded in Pimpri Beat of Chichinagovtha Range, Dangs (South) Division, which could be either of a cub-adult tigress or a large panther.

(9) One Shri Ahmadbhai Adambhai Memon of Waghai has given a statement to the effect that he had personally seen two grown up tiger cubs about one year old on 7-4-1979, crossing the road in front of his motor cycle near the botanical garden staff quarters late in the evening, while he was returning to Waghai. The tiger droppings were also collected from this area on 18-4-1979. However, in absence of any pugmarks and further verification by a respoinsible member of the forest staff, these tiger cubs have not been included for the purpose of census.

(10) Shri Khare, Asst. Conservator of Forests, working with the Forest Development Corporation has staded that on 23-3-1979 he had clearly seen a tiger by the side of the road near Khanbda Signboard just outside the Bansda National Park area. He is very positive about his identification of the animal which was also seen by the other occupants in his jeep. About a week later Shri Babaliya Dangi of Sadaddevi, who is an old and experienced hand in the tracking of wild animals saw a big male tiger sitting in a nala which growled at him as he approached and then disappeared. Both these sightings are probably of the same animal whose beat covers the Bansda National Park area and the forests adjoining Waghai. However in the absence of any pugmarks this case has not been included for the purpose of the census.

11 A tigress with cubs was reported from Takalipada Beat of Galkund Range on 19-4-1979. However, no further confirmation of this was forthcoming, either through pugmarks or a kill, although tiger droppings were located elsewhere in the Range. Hence this case has not been included for the purpose of census.

Thus, in the final analysis, it can definitely be recorded that there were 7 tigers in Gujarat State during the census period from 15th to 21st April, consisting of 4 males and 3 females, distributed over the following divisions:

Dangs (North) : 3 males and 2 females

Dangs (South) : 1 female.

Rajpipla (East) : 1 male.

Advantage of this tiger census was also taken to estimate the population of panthers in Dangs District i.e. Dangs (North) Dangs (South) Divisions. These observations indicate that there are approximately 70 panthers in this District, which can be considered to be a fairly substantial number.

The expenditure on this census comes to Rs. 5000/- approximately, covering such items as fuel charge for jeeps, wages of trackers and other miscellaneous expenditure. A few live baits were also tied up at some likely places but no kills by tiger took place.

The following non-officials very kindly consented to associate themselves with the above census as non-official observers, viz. (1) Shri Digveerendrasinhji I. Solanki of Bansda for Dangs and Valsad Districts (2) Shri Jamshedji D. Gabba of Bilimora for Valsad District, (3) Dr. Nanyann T. Mascati of Surat for Surat District (4) Shri Kasimkhan J. Khan of Jhagadia for Bharuch District. (5) Shri Madhusudansinhji of Danta for Banaskantha District. I would like to place on record my deep sense of gratitude to all these gentlemen for having so kindly offered their voluntary services for the census work, particularly Shri Digveerendrasinhji and Shri K.J. Khan who ungrudgingly spared their valuable time and took a lot of trouble at considerable personal discomfort to tour the forest areas extensively for the verification of pugmarks, etc.

During the last all India Tiger Census conducted in 1972, 8 tigers had been reported from Gujarat Stat, all of them from Dangs District. Against this, the present census has indicated the existence of 6 tigers in Dangs District and one in Rajpipla (East) Division (Bharuch District). It appears quite obvious that the tiger in Gujarat is struggling for survival and its population in the State is on the decline. The main adverse factors which the tiger has to face may briefly be enumerated as under:

A steady reduction and consistent human disturbance in its habitat. Among the more serious causes of disturbance may be mentioned the industrial exploitation of bamboos, intensive management of the forest (particularly in Dangs), the collection of minor forest produce by the tribals resulting in recurring forest fires, and the heavy depletion of wild ungulate population due to persistent poaching by the tribals, particularly during the critical summer months. With hardly any natural prey left for the tiger, it is compelled to turn to domestic cattle. But here also he has to face severe competition because the moment a kill is detected, the local tribals rush in to drive the tiger away from his kill and to appropriate the meat for their own consumption. It is virtually impossible for the tiger to survive under these conditions, although the panther can always manage to eke out a living even under such unfavourable conditions.

Rajasthan Tiger Reserves

SARISKA

The living forests of Sariska close to growing cities—Delhi and Jaipur — is a rare escape from man's destructive hand. It can only be described as a miracle. The wide spectrum and rich population of wild life—the Sambhar, Nilgai, wild-boar, Chital and four-horned antelope and presence of the leopard and the tiger living in the bone-dry forests which are leafless for over six months in a year, is an example of the marvel of ecological adjustment, adaptation and tolerance. Sariska is truly a natural wonder.

The Aravallies, which run in continuous sharp ridges, branch at Sariska and again regroup to form a bulge in the otherwise a continuous single ridge range reaching Delhi. The topography of undulating plateau-lands and wide valleys, generally unknown in the system, constitute the major part of the Reserve. Still the hills maintain the Aravalli character of sharp hogback ridges. The forests are dry deciduous type and are dominated by 'Dhok'¹ with the belts of Salar on steep dry slopes and Dhak² in valleys. The landscape changes its colour from lucious green in the rains to copper brown to grey in winter, finally to drab grey in Summer. Monotony of the grey tone is broken by the splash of reds of flowering of 'the flame of the forest'—Dhak in March-April.

Sariska has characteristic fauna of dry zone and antelopes, and deer and caracal jungle cat, hyaena, jackal, ratel and the tiger, the rich avifauna, specially, shrikes, paradise fly-catchers and the parakeets including the colourful blossom-headed and the Alexander parakeets and the peafowl are conspicuous. Sariska is an ideal habitat to be a Tiger Reserve.

The 9th and 10th Century ruins of shivite temples of the Garh-Rajor are the contemporary of the Khajuraho archaeology. The distinction it has is the ten metre single piece statue of Lord Mahavir and a few Jain temples in the same archaeological complex. The mediaeval history of the Moghals and the Rajputs is preserved in the Fort of Kankwari. The Place of Sariska and scattered shooting Odhies are the relics of the splendour of the rule of the Maharajas of the British Raj. No tiger Reserve combines a rich heritage of natural history and history as Sariska does.

Sariska's proximity to Jaipur and Delhi, its accessibility throughout the year and rich natural and historical heritage establishes it as a show-window of the Project Tiger, India.

1. Dhok (*Anogeissus pendula*)

2. Dhak (*Butea monosperma*)

RANTHAMBHORE

Ranthambhore enjoys a coveted place in the history of India where more battles were lost than won. The graves and cenotaphs in ruins are the mute relics of sieges that lasted not months but years. The centre of human activity till 200 years ago, when left to nature, has demonstrated the unfailing confidence of nature in re-establishing it as a fine wildlife reserve, the Natural history of which is second to none among the other ten Tiger Reserves of the country.

Geology of Ranthambhore is complex and confusing. The Vindhyan flat hill tops, gentle sloping syncline slopes on one side and steep scarpments show clear inclined horizons of sandstone, quartzite and occasionally horizontal shale beds. The razor sharp ridges represent the Aravallies on the outskirts of the Reserve.

As a typical representative of the tropical dry deciduous vegetation the forest is dominated by Dhok. In early rains specially when the leaves are young the foliage is beautifully green, and finally before falling with gentle breeze, it turns grey. The forest in summer is dry, and drab but it gets punctuated with red flowers of the 'flame of the forest', Dhak in March and light yellow of the flowering of Amaltas in June. Salai and Karaya are dry for most part of the year but their skeletal design display fine anatomy of the trees. A drive through Jamun & Mango ever green ever-glades is thrilling as one would expect a tiger cooling himself in the river pools even in winters. The glades are microclimates distinctly different from the adjoining forest. In summer they really present a contrast of climates changing within few metres. The glades present a refreshing cool environment.

The Baniyan—the tree that walks is the speciality of the vegetation. The tree at Jogi Mahal is the protected tree of Rajasthan. It has a spread of 2000 sq. metres. Even the mango trees growing luxuriously in the valleys reconform of the tropical environment.

The Tiger appears to have well established himself in Ranthambhore. There are about 20 resident tigers and a few visit the reserve in winters. The common leopard shares the habitat. But the number of Jackals is large and they compete with the tiger. Others who share with tiger are hyaenas and sloth bears. It is the population of Sambhar and wildboar that attract the predators. According to the last count there are 3100 Sambhar and 1835 wildboars in addition to 3290 Chital and 1569 Nilgai. This establishes Ranthambhore, hardly 400 Sq. km. of an area, as the reserve with the richest population of the Sambhar. Among tiger Reserves it is the only place where Chinkara is conspicuous. Population density of common langur in the reserve is also highest in the country.

Being dry deciduous ecosystem interspersed with evergreen glades, it is rich in avifauna. The paradise flycatcher, partridge, painted spurfowl and peafowl, green pigeon, quails,

lapwings and sand grouse are common. Night jays and spotted owlets are visible at night. The vultures including the king and white back always looking for the dead, are present. Crested serpent eagle is conspicuous.

The wild paradise is on display in the afternoons when Sambhar arrive to feed in the aquatic ecosystem of Mirag, and Padam talab and Rajbag lake. The shore of these lakes are the centres of activity of wildboars, Chital and Nilgai.

Ranthambhore is only 9 kms. from Sawaimadhopur which is approachable both by road and rail. It is 170 kms. from Jaipur, and about 6 hours train journey from Delhi.

For further details contact the Field Director, Sariska, Alwar and Field Director, Ranthambhore, Sawaimadhpur. Phone 223.

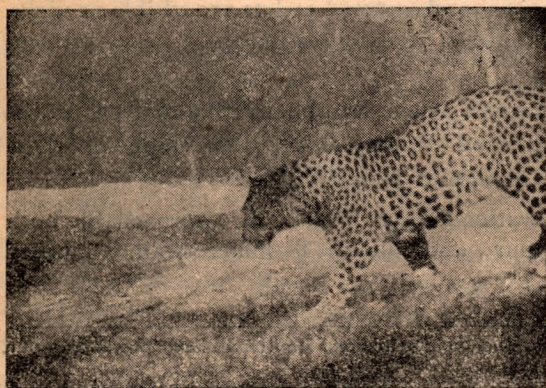
Book Review

The Wildlife of Ladakh by J.N. Ganhar, Haramukh Publications, Srinagar, Kashmir, Price Rs. 40/-.

Ladakh presents a unique ecological habitat with most interesting fauna most of which is found nowhere else. Mr. Ganhar has brought a beautifully illustrated and well written book on the wildlife of the region at a time when most of the wildlife, not only in Ladakh but elsewhere in the country as well, is at the verge of extinction.

The book is divided in two sections—Wildlife : Common Characteristics and Wildlife Preservation. In the former the animals are headed into Wild Animals, Game Animals and Beasts of Prey. The animals described receive a comprehensive treatment by the author. In the section on preservation the author has summarised the game laws in the region from the time of the Maharaja of J. & K. before independence upto the present day. Mr. Ganhar rightly points out that the game-laws are very good but hardly enforced and urges the authorities in this respect. The book is very informative and presents interesting reading.

S.K. Sangal



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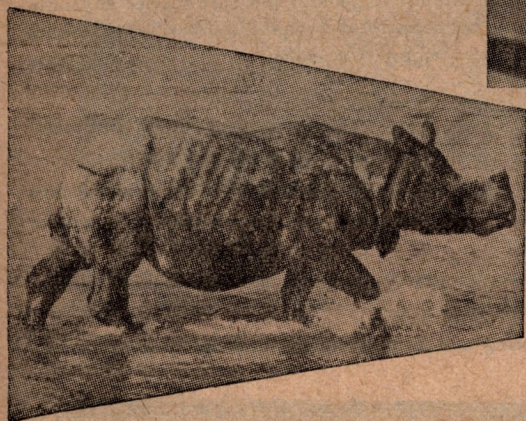
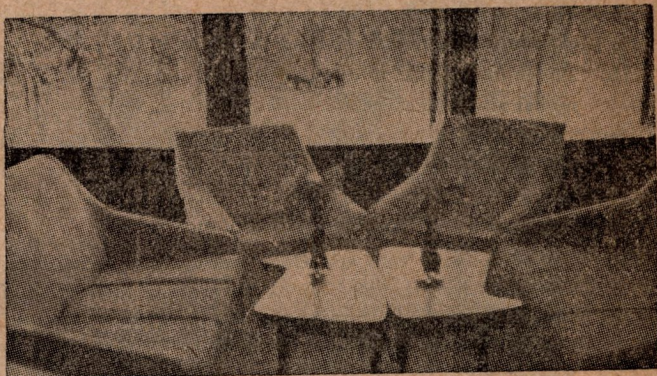
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1. The aims and objects of the Society are :—

- (a) To promote interest in and impart knowledge regarding the preservation and conservation of all forms of wildlife, particularly among the youth of the country
- (b) To co-operate with the Govts. of India and States and with other Societies and Institutions having similar aims and objects in working for the interests of wildlife
- (c) To assist in enforcing and actively supporting the Forest Acts, Wild Birds and Animals Protection Acts and Rules etc. of States and the Indian Arms Act and Rules in so far as they pertain to wildlife and to bring to the notice of the authorities any infringement of the same and to assist in the detection and prosecution of offenders in respect of such laws
- (d) To advise and help the Govt. and wildlife administrators in the formation, maintenance and protection of Sanctuaries and National Parks, the preservation of wildlife in general and rare species of India in particular and in the introduction of exotic species into the country, the rehabilitation of rare species etc. and in the revision on rational lines of the shooting and fishing rules, so as to conserve and increase wildlife stocks.
- (e) To raise funds for the carrying out of the above aims and objects and to found and maintain museums, reading rooms and libraries of natural history in order to disseminate knowledge regarding wildlife.
- (f) To promote sportsmanship in shikar and to recognise well regulated shooting and fishing, as a means of preserving wildlife and fish so that through wise use the surplus may provide a recreational asset to the nation.
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- (h) To assist members of the Society in obtaining shooting and fishing facilities and facilities for viewing and photographing wildlife in India
- (i) To conduct research into the problem of Wildlife management in India, and in pursuance of this, to initiate, encourage and, where possible assist in projects for the study of threatened species and related subjects and to provide reference and research facilities for such work
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For membership particulars write to Honorary Secretary, Wildlife Preservation Society of India, 7 Astley Hall, Dehra Dun.



Photo No. 3

A view of swamp forest cleared off by clean felling and draining off. Most of it has been allotted for agriculture and few still remains as marshy land.

(See Article on Page 21)



(See Article on Page 27)

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